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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/883,366	06/19/2001	Toshiya Ishio	1035-330	1077

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EXAMINER	
IM, JUNGHWA M	

ART UNIT	PAPER NUMBER
2811	

DATE MAILED: 10/20/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/883,366	ISHIO ET AL.	
	Examiner	Art Unit	
	Junghwa M. Im	2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 July 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-10 and 17-35* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-10 and 17-35* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *09/10/2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-3, 6-10, 17-18, 22-29, 31, 33 and 35 are rejected under 35 U.S.C. 102(e) being anticipated by Maitani et al. (US 6656828), hereinafter Maitani.

Regarding claims 1, 6-7 and 17, Fig. 5 of Maitani shows a semiconductor device comprising:

a main conductor layer/a wiring layer (6; Cu) having an end that is electrically connected to an electrode pad (BP);

an insulating layer (3) having an opening section on said main conductor layer;

a protrudent electrode (2) electrically connected to the main conductor layer via said opening section, the bump made of a metal having Sn as its main component (col. 7, line 51); and

a metal layer (15) provided completely covering a bottom surface, but not completely covering side surfaces, of the opening section on the main conductor layer so that said metal layer is provided between said main conductor layer and the protrudent electrode.

Regarding claims 2 and 31, Maitani discloses the metal layer is a metal having Au as its main component (col.7, lines 57-58), therefore having good wettability to the electrode.

Regarding claim 3, Maitani discloses the metal layer has a thickness ranging from 0.003 um to 1 um (col.9, lines 56-57).

Regarding claim 8, Fig. 5 of Maitani shows a barrier metal layer (14) made of Ni or a metal having Ni as its main component, on an entire top surface of the said main conductor layer (col.9, lines 18-22).

Regarding claim 9, Fig. 5 of Maitani shows the barrier metal layer covers side surfaces of the main conductor layer.

Regarding claim 10, Fig. 5 of Maitani shows a foundation metal layer (13) made of Ti, Ti-w, Cr, or a metal having any of those elements as its main component, under the main conductor layer (col.7, line 23).

Regarding claim 18, Fig. 5 of Maitani shows the main conductor/wiring layer comprises first (6) and the second (13) metal layers.

Regarding claim 22, Fig. 5 of Maitani shows a protruding electrode bump.

Regarding claim 23, Fig. 5 of Maitani shows the conductive wiring layer is connected to the electrode pad (BP) via an opening formed in another insulating layer.

Regarding claim 24, Maitani discloses that the other insulating layer comprises an inorganic layer (10, 11; SiO_2; col. 7, line 66) and an organic layer (4; polyimide; col. 6, line 13).

Regarding claims 25, 28 and 35, Fig. 5 of Maitani shows a semiconductor device comprising:

a semiconductor device comprising:

a conductive wiring layer (6) connected to an electrode pad (BP), an insulating layer (3; polyimide resin) on the conductive wiring layer having an opening which exposes an upper

portion of the conductive layer, a metal layer (15) having lateral dimensions by the size of the opening, completely covering the upper surface of the conductive wiring layer in the opening section but not completely covering the sides of the opening, and a bump electrode (2) being mainly made of Sn electrically connected to the conductive wiring layer via said opening section; and

wherein the conductive wiring layer comprises first (6), second (13) and the third (14) metal layers, the third layer (14; Ni) having low reactivity with the insulating layer.

Regarding claims 26, 29 and 33, Fig. 5 of Maitani shows a metal layer (15) comprises Au (col.7, lines 57-58), therefore having good wettability to the electrode.

Regarding claim 27, Fig. 5 of Maitani shows the third metal layer (14) comprises Ni.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 4-5, 20-21, 30, 32 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Maitani in view of Brouillette et al. (US 6341418), hereafter Brouillette.

Regarding claim 4, Maitani shows substantially the entire claimed structure except the metal layer in the opening having a Au layer and a nickel layer by electroplating. Fig. 2 of

Brouillette shows Au-Ni layer formation in the opening of the insulating layer by electroplating (col. 9, lines 32-40).

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the teachings of Brouillette into the device of Maitani in order to have a Au-Ni electroplating undermetal layer to enhance the reliability in connection between the conductive layer and the bump electrode.

Regarding claim 5, Maitani discloses the metal layer has a thickness ranging from 0.003 um to 1 um (col.9, lines 56-57).

Regarding claim 20, Maitani shows substantially the entire claimed structure except "said metal layer in the opening comprises a barrier metal layer and a top layer." Fig. 2 of Brouillette shows Au-Ni layer formation in the opening of the insulating layer by electroplating (col. 9, lines 32-40). It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the teachings of Brouillette into the device of Maitani in order to have a Au-Ni electroplating undermetal layer to enhance the reliability in connection between the conductive layer and the bump electrode. Also note that Fig. 5 of Maitani shows a Au layer in the opening.

Regarding claim 21, Maitani discloses the metal layer has a thickness ranging from 0.003 um to 1 um (col.9, lines 56-57)..

Regarding claim 30, Maitani shows substantially the entire claimed structure except "said metal layer comprises a barrier metal layer and a top layer, the top layer comprises a material having good wetting properties with respect to the material which comprises the protrudent electrode, and the barrier metal layer comprises a material preventing interdiffusion of a material comprising the main conductor layer and the material comprising the top layer." Fig. 2 of

Brouillette shows Au-Ni layer formation in the opening of the insulating layer by electroplating (col. 9, lines 32-40).

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the teachings of Brouillette into the device of Maitani in order to have a Au-Ni electroplating undermetal layer to enhance the reliability in connection between the conductive layer and the bump electrode.

The subject matter regarding claims 32 and 34 has been discussed in claim 30.

Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Maitani in view of Greer (US 6451681).

Regarding claim 19, Maitani shows substantially the entire claimed structure except "the first layer having a barrier layer and an adhesion layer. Fig.3 of Greer shows the first layer having a barrier layer (122) and an adhesion layer (200).

It would have been obvious to one of ordinary skill in the art to incorporate the teachings of Greer of into the device of Maitani in order to have a multi-layered metal layer to improve the connection between the bump and the wiring layer.

Response to Arguments

Applicant's arguments with respect to pending claims have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Junghwa M. Im whose telephone number is (571) 272-1655. The examiner can normally be reached on MON.-FRI. 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie C Lee can be reached on (571) 272-1732. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

jmi

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SUPERVISORY PATENT EXAMINER
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